

**Landbird Monitoring  
Channel Islands National Park  
1993 Annual Report**

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## ABSTRACT

Landbird population monitoring was initiated in 1993 at Channel Islands National Park, as part of a comprehensive prototype monitoring program designed to detect changes in the status of park natural resources. Annual relative abundance of breeding landbirds on park islands is derived from line transect sampling, in which an observer records all birds detected within 100 meters of the transect midline. Existing island trail systems, of varying length, are used as transects. Landbird surveys were conducted in spring and fall on three transects on Santa Barbara Island, one on Anacapa Island, and five on San Miguel Island. A total of 42 species was recorded on spring and fall surveys. To evaluate seasonal differences in detection, detection cue type (song, call or visual) was recorded for each individual bird detected on most of the transects. Only four species were detected in sufficient numbers during both seasons, and percent audio detections was less in the fall for two of four species examined, and at least one breeding species (Orange-crowned Warbler [*Vermivora celata*]) had migrated by the time fall surveys were implemented. Higher numbers of Song Sparrows (*Melospiza melodia*) recorded on San Miguel Island in the fall may represent the influx from recruitment. Results from spring and fall surveys suggested that landbird species were distributed by habitat type.

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## INTRODUCTION

National Park Service (NPS) managers are charged with maintaining all the components and processes of naturally evolving park ecosystems (NPS 1988). In order to make intelligent decisions regarding management of complex natural resource systems, managers of parks and other natural reserves require information on long-term resource condition and trend. Without such information, managers cannot gauge the effects of human activities on park resources, and therefore cannot prescribe and implement appropriate mitigative measures.

Recognizing that long-term datasets are required for management of park areas, the NPS has directed its managers to acquire such information in order to detect changes that may require mitigation and to provide reference points for comparison with other, more altered environments (NPS 1988). Accordingly, the NPS at Channel Islands National Park has initiated a long-term ecological monitoring program for both marine and terrestrial natural resources (Davis and Halvorson 1988), based upon monitoring the population dynamics of selected organisms. This population-based approach was chosen rather than other indices (biodiversity, energy flux, nutrient budgets, etc.) because the former integrates the effects of a broad range of ecological factors, permits projections into the future, reflects chronic system effects quickly, can be measured simply and interpreted directly, and provides information at levels most amenable to management: that of the species and population (Davis 1989). Protocols for monitoring populations and communities of terrestrial resources have been designed for terrestrial vertebrates, terrestrial vegetation, landbirds, terrestrial invertebrates and landbirds (Fellers and Arnold 1988, Halvorson et al. 1988, van Riper et al. 1988, Fellers and Drost 1991).

In 1993, landbird population monitoring was initiated at Channel Islands National Park.

Other land management agencies and scientific organizations are initiating population monitoring programs for landbirds (Butcher et al. 1993, Geupel 1993, Manley 1993, Sauer 1993), prompted by an increasing concern about the effects of habitat destruction and fragmentation, and

specific concerns for the fate of neotropical migrant species (Terborgh 1989, Hagan and Johnston 1992).

The importance of monitoring landbird populations at Channel Islands National Park is underscored by the existence of several endemic insular subspecies on the islands, as well as the recent history of habitat alteration due to human influences.

Landbird communities on southern California's Channel Islands are well-documented. As near-shore, or continental islands with faunal affinities to the adjacent mainland, California's Channel Islands have been the focus of studies on species composition and turnover among insular landbird populations (Diamond 1969, Power 1972, Lynch and Johnson 1974, Jones 1975, Jones and Diamond 1976, Power 1976, Diamond and Jones 1980, Kiff 1980) as well as studies on the origin and differentiation of island avifauna (Miller 1941, Miller 1951, Johnson 1972, Power 1979, Power 1980). Autecological studies have focused on endemic island subspecies such as the Santa Cruz Island scrub jay (*Aphelocoma coerulescens insularis*) (Atwood 1980), and San Miguel Island song sparrow (*Melospiza melodia micronyx*) (Sogge and van Riper 1988). Population monitoring of landbirds occurring on California's Channel Islands has not been previously attempted, although The Nature Conservancy is currently initiating landbird population monitoring on Santa Cruz Island (R. Klinger, pers. comm.).

Breeding landbird communities on the islands are depauperate when compared to those of the mainland. Diamond and Jones (1980) summarized the breeding avifauna on the Channel Islands and noted the differences between island avifauna and that of the adjacent mainland. Approximately 160 species breed on the adjacent mainland, whereas each of the eight Channel Islands support between eight and 39 species. Mainland species absent on the islands include sedentary species such as the Wrentit (*Chamaea fasciata*) and California Towhee (*Pipilo crissalis*), strong overland fliers such as the Red-shouldered Hawk (*Buteo lineatus*) and Turkey Vulture (*Cathartes aura*) which are not inclined to cross water, species for which there exists no suitable breeding habitat on the islands, such as Hermit Thrush (*Catharus guttatus*) and Fox Sparrow (*Passerella iliaca*), and some species which may be

outcompeted by other successfully breeding island species (Anna's Hummingbird [*Calypte anna*] and Allen's Hummingbird [*Selasphorus sasin*]). Those species which do breed regularly on the islands are characterized by a high degree of endemism. Of the approximately 41 island landbird species, 13 have differentiated into 18 endemic subspecies (Johnson 1972).

The landbird monitoring protocol developed for Channel Islands National Park (van Riper et al. 1988) is designed to monitor populations of landbird species which breed on Santa Barbara, Anacapa and San Miguel Islands through the use of line transect sampling during both the breeding and non-breeding seasons. Line transects utilizing existing trail systems were chosen over point counts because line transect sampling accurately reflects species composition, relative abundance and seasonal distribution patterns while minimizing the impacts of sampling on island vegetation (Sogge et al. 1989). The landbird monitoring program currently being developed for Santa Rosa Island (Super et al., in prep.) primarily utilizes point count sampling, which is more appropriate for that island's structurally complex habitats and rugged terrain, both of which make line transect sampling difficult to implement. Line transect sampling is most appropriate for sampling landbird populations in open, low-growth habitats (Dawson 1981), such as those on the smaller, less topographically diverse Channel Islands.

The objectives of the landbird monitoring program at Channel Islands National Park are to determine annual relative abundance of each species breeding on park islands, and to detect substantial changes in the abundance and/or distribution of landbirds. Such changes may be due to either natural factors or human-caused influences; historic and recent land-use practices have had severe consequences for island avifaunas. For example, the Santa Barbara Island Song Sparrow (*Melospiza melodia graminea*) was driven to extinction by 1959 due to a combination of conversion of native habitat for agricultural purposes, habitat destruction by introduced rabbits (*Oryctolagus cuniculus*) and other grazing stock, and predation by feral cats (*Felis catus*) (Sumner 1959). These same land-use practices on Santa Barbara Island have also reduced available breeding habitat for the Orange-crowned Warbler



(*Vermivora celata sordida*), a neotropical migrant which, on Santa Barbara, nests only in the thick stands of *Coreopsis* scrub in the canyons. As the island recovers from the influences of past grazing, expansion of *Coreopsis* stands may be accompanied by an increase in breeding Orange-crowned Warblers. The landbird monitoring program is designed to detect such changes, through correlation of landbird trends with attendant trends in other ecosystem components.

The purpose of this report is to present results from the first year of landbird monitoring at Channel Islands National Park. Data presented include abundance counts for line transect sampling, and data on detection cue type.

## MATERIALS AND METHODS

### **Study Area**

The California Channel Islands comprise eight islands located at various distances from the mainland in the Southern California Bight (Fig. 1), of which five are included in Channel Islands National Park. The islands range in size from less than 300 ha (Anacapa and Santa Barbara) to over 25,000 ha (Santa Cruz). Of the park islands, Anacapa is closest to the mainland, being 22 km from the coast, whereas Santa Barbara lies 73 km from the mainland. The larger islands are topographically diverse, and support a variety of habitat types, ranging from annual grasslands to coastal scrub communities and oak and conifer woodlands (Halvorson et al. 1988). The landbird monitoring program samples populations in all habitats on Santa Barbara, East Anacapa and San Miguel Islands (Table 1).

### **Landbird Monitoring Methods**

Van Riper et al. (1988) identified three methods for monitoring landbird populations at Channel Islands National Park. First, species relative abundance is to be estimated annually during both breeding and non-breeding seasons via a line transect sampling method from the islands' trail systems. Second, landbird densities are to be estimated via line transect sampling and variable circular plots once

every five years, with the intention of subsequently applying conversion factors to the annual relative abundance data to produce estimates of relative density. Third, intense observations are to be made throughout the breeding season of species selected as representative of various feeding guilds.

The first method, estimation of relative abundance from transect counts, was the only method implemented in 1993, for the following reasons. First, the method of calibrating the annual relative abundance counts via variable circular plot density estimation has been found to be unworkable

Figure 1. Channel Islands National Park, southern California.

Table 1. Landbird transects at Channel Islands National Park (habitat types are from Halvorson et. al 1988).

Island	Transect	Length (km)	Habitat Types	Route
Santa Barbara	Canyons	2.5	Corzopsis Scrub Wild Oats Boxthorn Scrub Maritime Cactus Scrub	Starts in Landing Cove Canyon and proceeds through Cave, Middle and Graveyard Canyons to the large Corzopsis stand east of Signal Peak.
	Arch Point Loop	5.4	Wild Oats Sea Cliff Scrub Coastal Sage Scrub	Starts at the island residence, proceeds up to the Saddle between North and Signal Peaks, follows the upper east slope of North Peak out to Arch Point and returns to the residence via Cliff Canyon.
	Elephant Seal Cove Trail	1.5	Wild Oats Sea-blitz Scrub Coastal Sage Scrub	Starts at the Saddle, proceeding west down across Webster Point to Elephant Seal overlook.
	Signal Peak	6.25	Wild Oats Sea Cliff Scrub Coastal Sage Scrub	Proceeds from the Saddle to Signal Peak, east through Cat Canyon, and across the Badlands.
East Anacapa	Trails	3.5	Corzopsis Scrub Annual leplant Coastal Sage Scrub	Starts at the lighthouse gate, proceeds past the bunkhouse and helicopter pad to the campground, on to Inspiration Point and return to residence via Cathedral Cove trail.

Table 1. Landbird transects at Channel Islands National Park (cont.).

San Miguel	San Miguel Hill	2.5	Corzopsis Scrub Wild Oats Coastal Sage Scrub Caliche Scrub Haplopappus Scrub	Starts at Nidever Canyon residence, proceeds up past airstrip to San Miguel Hill.
	Dry Lakebed	5.4	Wild Oats Coastal Sage Scrub Caliche Scrub Haplopappus Scrub Lupine Scrub	Proceeds along Cross-Island Trail from San Miguel Hill over Green Mountain to Dry Lakebed.
	Harris Point	1.6	Lupine Scrub Haplopappus Scrub	Proceeds from junction of Harris Point trail and jeep trail 1.6 km north.
	Willow Canyon	3.0	Corzopsis Scrub Coastal Sage Scrub Haplopappus Scrub	Proceeds down Willow Canyon to Willow Cove.
	Nidever Canyon	1.4	Corzopsis Scrub	Proceeds from the mouth of Nidever Canyon to the junction with the campground trail.

and so has been abandoned (Mark Sogge, pers. comm.); simple annual line transect counts are sufficient to detect significant changes in avian species diversity and abundance (Sogge et al. 1989). Second, problems with the use of indicator species has rendered that approach untenable (Mark Sogge, pers. comm.), and thus, there are no plans to develop monitoring methods for such.

Line transect counts were conducted on the transect routes identified by van Riper et al. (1988) for Santa Barbara, East Anacapa, and San Miguel islands (Table 1, Figures 2-4), with the exception of Elephant Seal Cove Trail on Santa Barbara Island, which is near a large Western Gull

Figure 2. Landbird transect locations, Santa Barbara Island, Channel Islands National Park.

Figure 3. Landbird transect locations, East Anacapa Island, Channel Islands National Park.

Figure 4. Landbird transect locations, San Miguel Island, Channel Islands National Park.



(*Larus occidentalis*) colony on Webster Point. Although that transect was run once in the spring, vocalizations by gulls made it impossible to detect landbird calls and songs; therefore, results are not reported. An additional transect route was added on San Miguel (Nidever Canyon) in order to sample the *Coreopsis* scrub habitat in that canyon.

Transects were surveyed in both breeding (March - April) and non-breeding (October - November) seasons. Spring surveys were conducted between March 4 and April 29; fall surveys were conducted between October 14 and November 5. Transects were surveyed once each season, with the exception of the Canyons transect on Santa Barbara and the Trails transect on East Anacapa, each of which was surveyed twice in the spring. Survey techniques used were those prescribed by van Riper et al. (1988). The observer recorded all landbird species detected, by visual or audio cue, within 100 m of the transect midline, while walking the transect at the prescribed time of day and at windspeeds less than 10 knots. Although not included in the monitoring protocol, I also collected data on detection cue type to investigate some aspects of detectability. Thus, on all surveys (except those on San Miguel in the fall), the type of cue (call, song or visual) was recorded for each bird detection.

Landbird observations derived from the line transect counts were summarized by species for each transect in each season. To quantify one aspect of seasonal variability in detection, the distribution of detection by cue type was summarized for each species with more than 15 detections per season. Chi-square tests were used to determine whether cue type differed between seasons for the four species with more than 15 detections in each season; Yates correction for continuity was applied to decrease bias in 2 X 2 contingency tables (Zar 1984). Significance level was set at 0.05 for all tests.

## RESULTS AND DISCUSSION

### **Species Observed**

A total of 47 landbird species was recorded during spring and fall landbird surveys on Santa Barbara, East Anacapa, and San Miguel Islands (Appendix A; scientific names of landbirds are given in

Appendix A and are therefore not mentioned hereafter for those species). The following comparison with the breeding landbird species list compiled by Jones and Diamond (1980) for the Channel Islands reveals some differences in species observed. These differences may result from differences in sampling method or effort; alternatively, they may reflect actual changes in island avifauna.

On Santa Barbara Island, Jones and Diamond identified the American Kestrel and Orange-crowned Warbler as occasional (as opposed to regular) breeders; those species bred on the island in 1993, and recent observations indicate them to be regular breeders. Conversely, the Costa's Hummingbird (*Calypte costae*), Barn Swallow, and Loggerhead Shrike were formerly identified as occasional breeders on Santa Barbara Island but were not observed in the spring or summer surveys in 1993. Sogge et al. (1989) reported that Barn Swallows breeding on Santa Barbara Island are often missed during spring and fall surveys because they do not arrive until late spring or early summer, and depart shortly thereafter. They may have bred on Santa Barbara Island in 1993, but the spring landbird surveys did not record them.

On Anacapa Island, the Black Phoebe and Common Raven, listed by Jones and Diamond as occasional breeders on Anacapa, were both observed during the spring in 1993 on East Anacapa. The Barn Owl, White-throated Swift (*Aeronautes saxatalis*), Pacific Slope Flycatcher (*Empidonax difficilis*) (formerly the Western Flycatcher; American Ornithologists' Union 1989) and Rock Wren were reported as regular breeders on Anacapa by Jones and Diamond, but were not recorded on East Anacapa Island in this study. Similarly, the Mourning Dove (*Zenaida macroura*), Northern Mockingbird (*Mimus polyglottos*), Loggerhead Shrike, Hutton's Vireo (*Vireo huttoni*), and Rufous-crowned Sparrow (*Aimophila ruficeps*) were formerly listed as occasional breeders on Anacapa but were not recorded in 1993. Whereas some of these species may truly not have bred on Anacapa in 1993, some may have bred on Middle and West Anacapa, but were not recorded because they do not occur on East Anacapa, which is the location of the landbird monitoring transect for that island. For example, Rufous-crowned

Sparrows were observed on Middle and West in the spring (Tim Thomas, USFWS, pers. comm.) but not on East. Middle and West are larger in area than East, and have more topographic diversity and more native shrub habitat; more landbird species may breed on those islets than on East Anacapa. Moreover, the total transect distance on East Anacapa (3.5 km) is short compared to the total transect distances on Santa Barbara (15.7 km) and San Miguel islands (13.7 km).

On San Miguel Island, all species listed as regular breeders by Jones and Diamond were observed in 1993. The only species listed by Jones and Diamond as an occasional breeder and not observed during the spring or fall counts was the Costa's Hummingbird. The Peregrine Falcon and Common Raven were both listed as extinct on San Miguel by Diamond and Jones, but were observed in 1993. Species formerly listed as occasional but observed during 1993 were the Red-tailed Hawk, Burrowing Owl, Loggerhead Shrike and Lesser Goldfinch.

### **Detection by Cue Type**

Detection by cue type for both the spring and fall sampling periods is presented in Table 2. Only four species (Yellow-rumped Warbler, Savannah Sparrow, White-crowned Sparrow and Western Meadowlark) were detected in sufficient number during both spring and fall to permit seasonal comparison of cue type. Of the four species for which comparisons can be made, only the

Table 2. Percent detection of birds by cue type, landbird monitoring surveys, Channel Islands National Park, spring and fall 1993.

species	n	% By Cue Type		
		CALL	SONG	VISUAL
SPRING SURVEYS				
Allen's Hummingbird	16	50	0	50
Horned Lark	183	27	0	73
Orange-crowned Warbler	103	35	40	25
Yellow-rumped Warbler	25	35	0	65
Savannah Sparrow	15	73	0	27
Song Sparrow	155	35	28	37
White-crowned Sparrow	151	32	4	64
Western Meadowlark	176	16	51	33
House Finch	30	37	23	40
FALL SURVEYS				
Yellow-rumped Warbler	52	4	0	96
Savannah Sparrow	21	48	0	52
White-crowned Sparrow	40	30	0	70
Western Meadowlark	93	0	40	60

Western Meadowlark is an island resident, or a breeder. When call and song were grouped as audio cues, chi-square analysis (Zar 1984) indicated that detection by cue type differed between spring and fall for Yellow-rumped Warbler ( $\chi^2 = 10.67$ ,  $p = 0.005$ ) and Western Meadowlarks ( $\chi^2 = 17.4$ ,  $p = 0.001$ ) but not for Savannah Sparrow ( $\chi^2 = 1.44$ ,  $p = 0.10$ ) or White-crowned Sparrow ( $\chi^2 = 0.32$ ,  $p = 0.5$ ). In the fall, detections by audio cue were less and detection by visual cues were greater than in the spring for both Yellow-rumped Warbler and Western Meadowlark. Seasonal differences in detectability can preclude between season comparisons (Bibby et al. 1992).

## **Landbird Abundance**

Results from the landbird surveys on Santa Barbara, East Anacapa, and San Miguel islands for spring and fall are presented in Tables 3 and 4, respectively. Most transects were surveyed once per season, but the Canyons and Trails transects were surveyed twice in the spring. For each of these transects, the replicate surveys compared well. For the Canyons transect, counts were similar for Orange-crowned Warblers (19 and 15), White-crowned Sparrows (35 and 36), and Western Meadowlark (15 and 16). For the Trails transect, counts were similar for Barn Swallows (13 and 11) and Orange-crowned Warblers (15 and 16), but different for flocking species such as European Starling (15 and 1), Yellow-rumped Warbler (8 and 0), and Western Meadowlark (9 and 17).

Some migrant species were recorded in both spring and fall (Yellow-rumped Warbler, Savannah Sparrow, and White-crowned Sparrow). Detections of Orange-crowned Warblers decreased considerably from spring to fall on all three islands, suggesting that most had migrated from the islands by the time of fall surveys. Orange-crowned Warblers are listed as migratory breeders on Santa Barbara Island but as residents on Anacapa and San Miguel (as well as Santa Cruz and Santa Rosa) by both Diamond and Jones (1980) and Jones et al. (1989). However, these data for Anacapa and San Miguel support the statement by Sogge et al. (1994) that Orange-crowned Warblers from the Channel Islands disperse after breeding, although a few remain on the islands.

Resident Song Sparrows are non-migratory on San Miguel (Sogge and van Riper 1988) and were observed in substantial numbers in both spring and fall; higher fall counts on some transects may reflect the influx from recruitment. Although there may be seasonal effects on detectability, the decrease in singing behavior by fall would tend to diminish the number of birds recorded, all other factors being equal; thus the apparent increase in fall Song Sparrows may represent an actual

Table 3. Landbird survey results from Channel Islands National Park, spring 1993. Values are number of birds detected within 100 m of transect midline for each transect.

Island <sup>1</sup> Date Transect <sup>2</sup>	SBI	SBI	SBI	SBI	CAI	CAI	SMI	SMI	SMI	SMI	SMI
	03/04	03/15	03/05	03/15	03/23	03/31	04/08	04/09	04/28	04/29	04/29
	CANY	CANY	ARCH	SGNL	TRLB	TRLB	HARR	NVVR	WILL	SMHL	LRRC
Red-shouldered Hawk			1								
Red-tailed Hawk											1
American Kestrel	2	5	1	6	1	1				1	
Peregrine Falcon										1	
Burrowing Owl	1										
Short-eared Owl	2	1									
Allen's Hummingbird									15	1	
Sage's Phoebe	6	2	1				1				
Western Kingbird					1						
Horned Lark			41	16			8			34	94
Barn Swallow					13	11					
Common Raven					1				1	4	
Rock Wren	1						1				
Bewick's Wren					1		1		2		1
Hermit Thrush	1										
European Starling	1	2	2		15	1					
Orange-crowned Warbler	19	15	2		15	16	1	10	19	5	1
Yellow-rumped Warbler	4	9			8						

Island <sup>1</sup> Date Transcet <sup>2</sup>	SBI	SBI	SBI	SBI	EAI	EAI	SMI	SMI	SMI	SMI	SMI
	03/04	03/15	03/05	03/13	03/23	03/31	04/08	04/09	04/28	04/29	04/29
	CANY	CANY	ARCH	SGNL	TRLS	TRLS	HARR	NVVR	WILL	SMTH	LRCE
Black-throated Gray Warbler	2										
Chipping Sparrow		1									
Lark Sparrow				2							
Savannah Sparrow				4	6	1	2				2
Song Sparrow							12	26	67	19	19
Golden-crowned Sparrow						1		2			
White-crowned Sparrow	35	36	8	4	35	25	2	1	6		
Western Meadowlark	15	16	29	37	9	17	5		3	4	25
House Finch					2		1	5	17		5
Lesser Goldfinch									2		1

<sup>1</sup>SBI Santa Barbara Island  
<sup>1</sup>EAI East Anacapa Island  
<sup>1</sup>SMI San Miguel Island

<sup>2</sup>CANY Cave, Middle and Graveyard Canyons  
 ARCH Arch Point Loop  
 SGNL Signal Peak Loop  
 TRLS East Anacapa Island Trail System  
 HARR Harris Point Administrative Trail  
 NVVR Nidever Canyon Trail  
 WILL Willow Canyon  
 SMTH Ranger Station to San Miguel Hill  
 LRCE San Miguel Hill to Dry Lakebed

Table 4. Landbird survey results from Channel Islands National Park, fall 1993. Values are number of birds detected within 100 m of transect midline for each transect.

Island <sup>1</sup> Date Transect <sup>2</sup>	SBI	SBI	CAI	SMI	SMI	SMI	SMI
	10/14	10/13	11/05	10/06	10/07	10/07	10/08
	CANY	SIGN	TRLS	WILB	SMHL	LAKE	HARR
Northern Harrier	1						
Sharp-shinned Hawk							1
Red-tailed Hawk				1		2	1
American Kestrel	1	5	1				
Peregrine Falcon			1				
Barn Owl				2			
Burrowing Owl	1			1			
Short-eared Owl	4						
Allen's Hummingbird				4			1
Northern Flicker		1					
Black Phoebe			1			1	
Say's Phoebe	1	1	7	2			
Western Kingbird							
Horned Lark		8		1	31	124	47
Cliff Swallow		4					
Barn Swallow							34
Common Raven				3	7	5	
Rock Wren	9			12	2	1	
Bewick's Wren			6				
House Wren			3				
Hermit Thrush	1						
Loggerhead Shrike				1			
European Starling			32	24			9
Orange-crowned Warbler	2	1	2	11			1
Yellow-rumped Warbler	18	10	24				
Palm Warbler			1				
Common Yellowthroat			1	1			
Rufous-sided Towhee			1				



Table 4. Landbird survey results from Channel Islands National Park, fall 1993 (cont.).

Island <sup>1</sup> Date Transsect <sup>2</sup>	SBI	SBI	EAI	SMI	SMI	SMI	SMI
	10/14	10/15	11/05	10/06	10/07	10/07	10/08
	CANY	SIGN	TRLS	WILL	SMHL	LRKE	HARR
Savannah Sparrow		18	9				
Song Sparrow				68	50	72	59
Golden-crowned Sparrow					2		
White-crowned Sparrow	4	4	32	1	1	2	2
Western Meadowlark	15	56	22	6	19	55	5
Brown-headed Cowbird	3						
House Finch			24	22	8	15	6
Lesser Goldfinch						1	

<sup>1</sup>SBI Santa Barbara Island

<sup>1</sup>EAI East Anacapa Island

<sup>1</sup>SMI San Miguel Island

<sup>2</sup>CANY Cave, Middle and Graveyard Canyons

<sup>2</sup>LRKE Fire Point Loop

<sup>2</sup>SIGN Signal Peak Loop

<sup>2</sup>TRLS East Anacapa Island Trail System

<sup>2</sup>HARR Harris Point Administrative Trail

<sup>2</sup>NDRV Nidever Canyon Trail

<sup>2</sup>WILL Willow Canyon

<sup>2</sup>SMHL Ranger Station to San Miguel Hill

<sup>2</sup>LRKE San Miguel Hill to Dry Lakebed

increase due to recruitment.

Results from the transect surveys suggested that landbird species were distributed, predictably, according to habitat type. For example, Orange-crowned Warblers were found primarily on transects in *Coreopsis* scrub habitat (such as the Canyons transect on Santa Barbara Island and the Trails transect on East Anacapa Island), whereas Western Meadowlarks and Horned Larks were found in more open habitats such as wild oat grassland (Signal Peak transect on Santa Barbara). Song Sparrows were recorded from all transects on San Miguel Island, but primarily from *Coreopsis* scrub, lupine scrub and *Haplopappus* scrub habitat types.

### **Recommendations for Future Monitoring**

The development of a monitoring program is an iterative process, and methods of field sampling and data analysis will necessarily change over time to reflect actual operating conditions, as well as in response to advances in sampling and analytical techniques. In the case of landbird monitoring, the protocol was published in 1988 but not implemented until 1993, and some of the intended methodology has since been dropped (see Materials and Methods). Moreover, several reviewers have expressed concern about the ability of the protocol to determine trends in landbird populations, to adequately sample the island landbird communities, and to characterize landbird use of different habitat types. These are valid concerns and should be addressed formally at some point. Ideally, monitoring programs should be periodically evaluated to determine whether, in fact, the resultant data are sufficient to detect change at the intended level. I would encourage such a review of the landbird monitoring program after several initial years of data collection. In the meantime, the park should investigate methods of data collection and analysis that address those concerns that have been raised.

Finally, landbird monitoring should be implemented on Santa Rosa and East Santa Cruz Islands, the two islands added to the park since the landbird protocol was developed. The land bird protocol for Santa Rosa Island is in draft form (Super et al., in prep.) and should be completed.

Landbird monitoring methodology and sites both need to be established for East Santa Cruz Island in coordination with The Nature Conservancy, which has developed a landbird monitoring protocol for the remainder of Santa Cruz Island.

## LITERATURE CITED

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Appendix 1. Landbird species recorded during spring and fall landbird surveys, 1993, at Channel Islands National Park (nomenclature follows American Ornithologists' Union 1983; breeding status according to Diamond and Jones 1980).

Species	Santa Barbara Island	East Anacapa Island	San Miguel Island
Northern Harrier <i>Circus cyaneus</i>	MF <sup>i</sup>		
Sharp-shinned Hawk <i>Accipiter striatus</i>			MF
Cooper's Hawk <i>Accipiter cooperi</i>		MS	
Red-shouldered Hawk <i>Buteo lineatus</i>	MS		
Red-tailed Hawk <i>Buteo jamaicensis</i>			PrBS,F
American Kestrel <i>Falco sparverius</i>	PrBS,F	PrBS,F	PrBS
Merlin <i>Falco columbarius</i>	MF		
Peregrine Falcon <i>Falco peregrinus</i>	S?	PrBF	PrBS
Barn Owl <i>Tyto alba</i>	PrBS,F		PrBS,F
Burrowing Owl <i>Athene cunicularia</i>	PrBS,F		PrBF
Short-eared Owl <i>Nisio flammæus</i>	?S,F		
Northern Flicker <i>Colaptes auratus</i>	MF		
Allen's Hummingbird <i>Selasphorus sasin</i>		PrBS	PrBS,F
Black Phoebe <i>Sagornis nigricans</i>	?S	?S,F	?S,F
Say's Phoebe <i>Sagornis saya</i>	?S,F	?S,F	?S,F
Western Kingbird <i>Tyrannus verticalis</i>		MS	

Appendix 1. Landbird species recorded during spring and fall landbird surveys, 1993, at Channel Islands National Park (cont.).

Species	Santa Barbara Island	East Anacapa Island	San Miguel Island
Horned Lark <i>Eremophila alpestris</i>	PrBS,F		PrBS,F
Cliff Swallow <i>Hirundo pyrrhonota</i>			MF
Barn Swallow <i>Hirundo rustica</i>		PrBS	PrBF
Common Raven <i>Corvus corax</i>		?S	PrBS,F
Rock Wren <i>Salpinctes obsoletus</i>	PrBS,F	PrBF	PrBS,F
Bewick's Wren <i>Thryomanes bewickii</i>		PrBS,F	
House Wren <i>Troglodytes aedon</i>		MF	
Ruby-crowned Kinglet <i>Regulus calendula</i>		MF	
Mountain Bluebird <i>Sialia currucoides</i>			
Hermit Thrush <i>Catharus guttatus</i>	MS,F		
Loggerhead Shrike <i>Lanius ludovicianus</i>			MF
European Starling <i>Sturnus vulgaris</i>	PrBS	PrBS,F	PrBS,F
Orange-crowned Warbler <i>Vermivora cclata</i>	PrBS,F	PrBS,F	PrBS,F
Yellow-rumped Warbler <i>Dendroica coronata</i>	MS,F	MS,F	MS
Black-throated Gray Warbler <i>Dendroica nigrescens</i>	MS,F		
Palm Warbler <i>Dendroica palmarum</i>		MF	
Black-and-white Warbler <i>Mniotilta varia</i>		MS	



Appendix 1. Landbird species recorded during spring and fall landbird surveys, 1993, at Channel Islands National Park (cont.).

Species	Santa Barbara Island	East Anacapa Island	San Miguel Island
Common Yellowthroat <i>Geothlypis trichas</i>		MF	MF
Western Tanager <i>Piranga rubra</i>			MS
Rufous-sided Towhee <i>Pipilo erythrophthalmus</i>		MF	
Chipping Sparrow <i>Spizella passerina</i>	MS	PrBS	
Lark Sparrow <i>Chondestes grammacus</i>	MS		
Savannah Sparrow <i>Pooecetes gramineus</i>	MS,F	MS,F	MS
Song Sparrow <i>Melospiza melodia</i>			PrBS,F
Golden-crowned Sparrow <i>Zonotrichia atricapilla</i>		MS	MS,F
White-crowned Sparrow <i>Zonotrichia leucophrys</i>	MS,F	MS,F	MS,F
Western Meadowlark <i>Sturnella neglecta</i>	PrBS,F	PrBS,F	PrBS,F
Brewer's Blackbird <i>Psarocolius cyanocephalus</i>	?F		
Northern Oriole <i>Icterus galbula</i>		MS	
House Finch <i>Carpodacus mexicanus</i>		PrBS,F	PrBS,F
Lesser Goldfinch <i>Carduelis psaltria</i>			SrBS,F

M = Migrant

Pr = Permanent resident (present year-round)

Sr = Summer resident

B = Known to breed on island

? = Breeding status on island unknown

S = Detected during spring landbird surveys

F = Detected during fall landbird surveys

